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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Chandra S. Chekuri et al.
Case: 2-4-4
Serial No.: 09/628,378
Filing Date: July 31, 2000
Group: 2662
Examiner: Donald L. Mills

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature: V. Bucchieri Date: September 9, 2004

Title: Methods and Apparatus for Design, Adjustment or Operation of Wireless Networks Using Pre-Frequency Assignment Optimization

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TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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Sir:

Submitted herewith are the following documents relating to the above-identified patent application:

(1) Appeal Brief in triplicate (original and two copies); and
(2) Copy of Notice of Appeal, filed on July 6, 2004, with copy of stamped return postcard indicating receipt of Notice by PTO on July 9, 2004.

There is an additional fee of $330 due in conjunction with this submission under 37 CFR §1.17(c). Please charge **Ryan, Mason & Lewis, LLP Account No. 50-0762** the amount of $330, to cover this fee. In the event of non-payment or improper payment of a required fee, the Commissioner is authorized to charge or to credit **Deposit Account No. 50-0762** as required to correct the error. A duplicate copy of this letter and two copies of the Appeal Brief are enclosed.

Respectfully submitted,

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Date: September 9, 2004

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s):	Chandra S. Chekuri et al.
Case:	2-4-4
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APPEAL BRIEF

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Sir:

Applicants hereby appeal the final rejection dated April 6, 2004 of claims 1-9 and 23-25 of the above-identified application.

REAL PARTY IN INTEREST

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded October 24, 2000 in the U.S. Patent and Trademark Office at Reel 011255, Frame 0280. The assignee Lucent Technologies Inc. is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

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STATUS OF CLAIMS

The present application was filed on July 31, 2000 with claims 1-25. Claims 1-25 are currently pending in the application. Claims 1 and 23-25 are the independent claims.

Claims 1-4, 8, 9 and 23-25 stand rejected under 35 U.S.C. §102(b). Claims 5, 6 and 7 stand rejected under 35 U.S.C. §103(a). Claims 10-22 are indicated as containing allowable subject matter. Claims 1-9 and 23-25 are appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is directed to methods, apparatus and other arrangements for providing a desired level of performance for a wireless network. The invention generally involves applying an optimization process to a set of information characterizing the network, where the optimization process comprises at least a pre-frequency-assignment optimization stage. The pre-frequency-assignment optimization stage is applied prior to assignment of frequencies to one or more communication channels of the wireless network. An output of the optimization process is used to determine at least one operating parameter of the wireless network.

In an illustrative embodiment of the invention, a processing system 10 comprising a processor 12 and memory 14 executes software for implementing an optimization process such as that shown in FIG. 3. The optimization process of FIG. 3 includes a pre-frequency-assignment optimization stage 102 that is performed before a frequency planning stage 104 and a post-frequency-assignment stage 106. The pre-frequency-assignment optimization stage 102, also referred to as Stage 1, may involve, for example, minimizing the co-channel and adjacent channel interference while maintaining a given level of coverage and blocking prior to the frequency planning stage. See the specification at, for example, page 9, lines 2-15.

The claimed arrangements provide significant advantages over conventional techniques. For example, the three-stage optimization process of the illustrative embodiment can provide significantly improved configurations for the network relative to those obtainable using conventional

techniques. More specifically, as indicated at page 9, lines 15-18, of the specification, generating a better frequency plan by using the Stage 1 optimization prior to frequency planning will generally lead to a better network design subsequent to frequency planning.

ISSUES PRESENTED FOR REVIEW

1. Whether claims 1-4, 8, 9 and 23-25 are anticipated under §102(b) by U.S. Patent No. 5,561,841 (hereinafter "Markus").

2. Whether claim 5 is unpatentable under §103(a) over Markus in view of U.S. Patent No. 6,128,497 (hereinafter "Faruque").

3. Whether claim 6 is unpatentable under §103(a) over Markus.

4. Whether claim 7 is unpatentable under §103(a) over Markus in view of U.S. Patent No. 5,404,574 (hereinafter "Benveniste").

GROUPING OF CLAIMS

With regard to Issue 1, claims 1, 4, 8 and 23-25 stand or fall together, claim 2 stands or falls alone, claim 3 stands or falls alone, and claim 9 stands or falls alone.

Each of the remaining issues relates to only a single claim, which stands or falls alone.

ARGUMENT

Issue 1

Applicants note that the Manual of Patent Examining Procedure (MPEP), Eight Edition, August 2001, §2131, specifies that a given claim is anticipated "only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference," citing Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Moreover, MPEP §2131 indicates that the cited reference must show the "identical invention . . . in as complete detail as is contained in the . . . claim," citing Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). For the reasons identified below, Applicants submit that the Examiner has failed to establish anticipation of claims 1-4, 8, 9 and 23-25 by the Markus reference.

Independent claim 1 is directed to a processor-implemented method for providing a desired level of performance for a wireless network. The method includes the steps of applying an optimization process to a set of information characterizing the network, the optimization process comprising at least a pre-frequency-assignment optimization stage, the pre-frequency-assignment optimization stage being applied prior to assignment of frequencies to one or more communication channels of the wireless network, and utilizing an output of the optimization process to determine at least one operating parameter of the wireless network.

The Examiner argues that Markus meets the above-noted limitations, relying on the teachings in column 5, lines 63-65, and column 11, lines 13-17 and 29-33. Applicants respectfully disagree. The first of the portions of Markus relied upon by the Examiner provides as follows, with emphasis supplied:

> The operator positions the network elements, primarily base stations BS, at desired locations on the digital map, and determines their antenna location, antenna power, antenna direction and frequency allocation. The object is to attempt to find optimal locations and parameters for the base stations, so that the coverages of the base stations cover the desired area completely with appropriate overlapping.

This aspect of Markus relates to a process that is referred to therein as "coverage planning." This process is distinct from frequency assignment, which in the Markus arrangements occurs in a stage referred to as "frequency planning." As Markus notes in column 1, lines 13-15:

> Cellular radio network planning can be divided into coverage, frequency, capacity, parameter and transmission planning.

Markus describes frequency planning and capacity planning in more detail at, for example, column 5, line 67 to column 6, line 7. The primary object of the Markus arrangements is to facilitate parameter planning after frequency assignment is complete. This is apparent from, for example, the discussion of parameter planning in column 1, lines 31-67.

As indicated above, the Examiner also relies on the teachings in column 11, lines 13-17 and 29-33 of Markus as allegedly disclosing the claimed pre-frequency-assignment optimization stage. However, this portion of Markus is described in column 11, lines 11-12, with emphasis supplied, as disclosing "optimizing applications [that] represent the most advanced level of further processing software." Such "further processing software" of Markus is more specifically described as follows at column 9, lines 47-55, with emphasis supplied:

> Even though it is also possible in the system according to the invention to realize follow-up during the simulation, the actual utility applications of the simulation are accomplished by post-processing the event statistics stored in the database 6. The aim is to screen-out relevant information, which can be performed by post-processing programs illustrated by the block 8 in FIG. 1. They can be classified according to their degree of advancement, as follows: graphics applications, analysing applications, and optimizing applications.

Thus, the optimizing applications referred to in column 11, lines 13-17 and 29-33 of Markus, and relied upon by the Examiner in formulating the anticipation rejection, are clearly a type of post-processing program corresponding to block 8 in FIG. 1 of Markus. Since these post-processing programs are applied after assignment of frequencies to communication channels of the system, they cannot reasonably be characterized as anticipating the claimed pre-frequency-assignment optimization stage of claim 1.

The Examiner in the final Office Action at page 7, section 8, states that Applicants have argued that "Markus discloses a process of network planning which only includes 'coverage planning.'" Applicants respectfully submit that the Examiner is misinterpreting their argument. As indicated at column 1, lines 13-15, Markus specifically teaches that cellular radio network planning can be divided into coverage planning, frequency planning, capacity planning, parameter planning and transmission planning, in that order. Markus at column 1, lines 15-17, further acknowledges that planning applications based on digital maps have recently been developed for coverage planning, frequency planning and capacity planning. However, Markus explicitly states that the invention

described therein relates to (i) parameter planning, that is, "optimization of the parameters of the cellular radio network," and (ii) full operational optimization of the cellular network. See column 2, lines 3-20.

The Markus invention thus involves two distinct optimizations, namely, optimization (i), which is explicitly described as a parameter planning optimization, and optimization (ii), which is a full operational optimization. However, neither optimization (i) nor optimization (ii) is anticipatory of the claimed optimization process comprising at least a pre-frequency-assignment optimization stage applied prior to assignment of frequencies to one or more communication channels. This is because optimization (i), being a parameter planning optimization, necessarily requires that frequencies have already been assigned. Similarly, a full operational optimization cannot be performed without assignment of frequencies.

The Examiner in responding to the arguments raised by Applicants again relies on column 5, lines 61-64, of Markus. However, this portion of Markus apparently relates to conventional aspects of the Nokia Network Planning System NPS/X as implemented in block 1 of FIG. 1. See column 4, lines 45-47, and column 1, lines 15-24. The "frequency allocation" referred to in the relied-upon passage at column 5, lines 61-64, clearly occurs prior to either optimization (i) or optimization (ii) of Markus, and thus constitutes an explicit teaching away from the claimed pre-frequency-assignment optimization stage.

In summary, the Examiner has failed to identify any optimization stage in Markus which occurs prior to frequency assignment. Optimization (i) of Markus is clearly a parameter planning optimization, which is explicitly described as occurring after frequency assignment, that is, subsequent to coverage planning and frequency planning. Similarly, optimization (ii) must also occur after frequency assignment, since it involves a full operational optimization that is not achievable without assignment of channel frequencies.

Markus therefore fails to teach the claimed arrangements which, in the illustrative embodiment of FIG. 3, comprise a pre-frequency-assignment optimization stage 102 that is performed before a frequency planning stage 104 and a post-frequency-assignment stage 106.

Since Markus fails to teach or suggest each and every limitation of independent claim 1, this claim is not anticipated by Markus. Independent claims 23-25 include limitations that are similarly

not met by the teachings of Markus, and are believed allowable for substantially the same reasons identified above with regard to claim 1.

Dependent claims 2-9 are believed allowable at least by virtue of their dependence from independent claim 1. Certain of these dependent claims are also believed to define additional separately-patentable subject matter relative to Markus and the other art of record, as indicated below.

With regard to dependent claim 2, this claim further specifies that the optimization process comprises a multi-stage optimization process having at least the pre-frequency-assignment optimization stage followed by a frequency assignment stage. Again, an example may be seen in the illustrative embodiment of FIG. 3, which includes a pre-frequency-assignment optimization stage 102, a frequency planning stage 104, and a post-frequency-assignment stage 106, performed in that order. Markus specifically teaches away from such an arrangement by teaching the performance of frequency planning before either the parameter planning optimization (i) or the full operational optimization (ii).

With regard to dependent claim 3, this claim calls for the pre-frequency-assignment optimization stage and the frequency assignment stage being repeated in an iterative manner. Markus fails to teach or suggest any pre-frequency-assignment optimization stage, and instead teaches parameter planning optimization (i) and full operational optimization (ii), both of which are explicitly described as occurring subsequent to frequency planning. Since Markus fails to teach or suggest a pre-frequency-assignment optimization stage, it cannot be interpreted as teaching iterative repetition of such a stage with a frequency assignment stage.

With regard to dependent claim 9, this claim specifies that the optimization process determines a network configuration for specified values of network capacity and network coverage. The Examiner in rejecting claim 9 relies on the teachings in column 5, lines 65-66, and column 6, lines 3-5. However, while the relied-upon passages do indeed mention the terms capacity and coverage, they fail to meet the particular limitation set forth in the claim. That is, they fail to teach or suggest the claimed optimization process which determines a network configuration for specified values of network capacity and network coverage.

Issue 2

Dependent claim 5 is believed allowable for at least the reasons identified above with regard to independent claim 1. The Faruque reference fails to supplement the above-described fundamental deficiency of Markus as applied to claim 1.

Issue 3

Dependent claim 6 is believed allowable for at least the reasons identified above with regard to independent claim 1.

Issue 4

Dependent claim 7 is believed allowable for at least the reasons identified above with regard to independent claim 1. The Benveniste reference fails to supplement the above-described fundamental deficiency of Markus as applied to claim 1.

In addition, Applicants note that dependent claim 7 calls for an optimization process utilizing a derivative-based optimization of a specified objective function. Illustrative examples of such derivative-based optimizations are described in the specification at, for example, page 11, line 19, to page 12, line 1, and page 18, line 13, to page 19, line 11. The portions of the Benveniste reference relied upon by the Examiner fail to teach or suggest optimization of an objective function through the use of one or more derivatives as claimed. In fact, there appears to be no mention whatsoever in the relied-upon portions of Benveniste regarding the term "derivative." Instead, there is a mention of a "method for deriving" which tends to suggest that the Examiner has failed to appreciate that the claimed derivative-based optimization utilizes one or more mathematical derivatives.

In view of the above, Applicants believe that claims 1-9 and 23-25 are in condition for allowance, and respectfully request the withdrawal of the §102(b) and §103(a) rejections.

Respectfully submitted,

Date: September 9, 2004

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APPENDIX

1. A processor-implemented method for providing a desired level of performance for a wireless network, the method comprising the steps of:

applying an optimization process to a set of information characterizing the network, the optimization process comprising at least a pre-frequency-assignment optimization stage, the pre-frequency-assignment optimization stage being applied prior to assignment of frequencies to one or more communication channels of the wireless network; and

utilizing an output of the optimization process to determine at least one operating parameter of the wireless network.

2. The method of claim 1 wherein the optimization process further comprises a multi-stage optimization process having at least the pre-frequency-assignment optimization stage followed by a frequency assignment stage.

3. The method of claim 2 wherein the pre-frequency-assignment optimization stage and the frequency assignment stage are repeated in an iterative manner.

4. The method of claim 2 wherein the frequency assignment stage comprises a frequency planning stage.

5. The method of claim 1 wherein the wireless network implements a frequency reuse factor greater than one.

6. The method of claim 1 wherein the wireless network comprises at least one of a TDMA wireless network, an FDMA wireless network, a CDMA wireless network, an OFDM wireless network, and a TDD wireless network.

7. The method of claim 1 wherein the optimization process utilizes a derivative-based optimization of a specified objective function.

8. The method of claim 1 wherein the operating parameter of the wireless network comprises at least one of a base station transmit power and an antenna orientation.

9. The method of claim 1 wherein the optimization process determines a network configuration for specified values of network capacity and network coverage.

10. The method of claim 1 wherein the optimization process generates a graphical display in the form of a tradeoff curve of capacity versus coverage.

11. The method of claim 1 wherein the optimization process generates a graphical display in the form of a tradeoff curve of percent carrier-to-interference ratio above threshold versus coverage.

12. The method of claim 1 the optimization process generates a graphical display in the form of a set of tradeoff curves comprising one or more tradeoff curves for each of a plurality of frequency plans.

13. The method of claim 1 wherein the optimization process assumes a particular frequency pattern in order to compute corresponding co-channel and adjacent-channel interference.

14. The method of claim 1 wherein the optimization process assumes a certain probability of co-channel and adjacent-channel likelihood in order to compute corresponding co-channel and adjacent-channel interference.

15. The method of claim 1 wherein the optimization process assumes that, for each of a plurality of sectors having more than one frequency, a carrier to interference ratio of every frequency at a given position in that sector is the same.

16. The method of claim 1 wherein a number of frequencies per cell sector of the wireless system is known prior to the application of the optimization process, and the process assumes that at least one sector has a different probability of being a co-channel interferer than other sectors.

17. The method of claim 1 wherein a number of frequencies per cell sector of the wireless system is unknown prior to the application of the optimization process and all cells are assumed to

have the same number of frequencies, and the process assumes that at least one sector has a different probability of being a co-channel interferer than the other sectors.

18. The method of claim 1 wherein the optimization process weights interference of each of a plurality of sectors of the system relative to a specified wanted sector by a probability and then sums the weighted interferences.

19. The method of claim 1 wherein the optimization process adjusts a probability of a particular system sector being a co-channel or adjacent-channel interferer so as to normalize a level of interference.

20. The method of claim 1 wherein an excluded sector or sectors having a zero probability of being a co-channel sector, relative to a given wanted sector in which is located a mobile station for which interference is to be calculated, comprise one or more sectors co-located with the wanted sector in a cell of the network and one or more first-adjacent sectors.

21. The method of claim 1 wherein the optimization process defines a carrier to interference ratio for a given position within the network as an average of a set of carrier to interference ratios for different frequencies of the corresponding sector of the network.

22. The method of claim 1 wherein the optimization process defines a carrier to interference ratio for a given position within the network as a maximum of a set of carrier to interference ratios for different frequencies of the corresponding sector of the network.

23. An apparatus for use in providing a desired level of performance for a wireless network, the apparatus comprising:

a processor-based system operative to apply an optimization process to a set of information characterizing the network, the optimization process comprising at least a pre-frequency-assignment optimization stage, the pre-frequency-assignment optimization stage being applied prior to assignment of frequencies to one or more communication channels of the wireless network;

wherein an output of the optimization process is utilized to determine at least one operating parameter of the wireless network.

24. An apparatus for use in providing a desired level of performance for a wireless network, the apparatus comprising:

means for applying an optimization process to a set of information characterizing the network, the optimization process comprising at least a pre-frequency-assignment optimization stage, the pre-frequency-assignment optimization stage being applied prior to assignment of frequencies to one or more communication channels of the wireless network; and

means for utilizing an output of the optimization process to determine at least one operating parameter of the wireless network.

25. An article of manufacture comprising a machine-readable medium for storing one or more software programs for use in providing a desired level of performance for a wireless network, wherein the one or more programs when executed by a processor-based system perform the step of:

applying an optimization process to a set of information characterizing the network, the optimization process comprising at least a pre-frequency-assignment optimization stage, the pre-frequency-assignment optimization stage being applied prior to assignment of frequencies to one or more communication channels of the wireless network;

wherein an output of the optimization process is utilized to determine at least one operating parameter of the wireless network.